DRAFT RECOVERY PLAN

FOR THE

NORTHERN IDAHO GROUND SQUIRREL

(Spermophilus brunneus brunneus)

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Region 1
U.S. Fish and Wildlife Service
Portland, Oregon

Regional Director, Region 1, U.S. Fish and Wildlife Service

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Recovery plans delineate reasonable actions that are believed to be required to recover and/or protect listed species. Plans are published by the U.S. Fish and Wildlife Service, sometimes prepared with the assistance of recovery teams, contractors, State and Federal agencies, and others. Objectives will be attained and any necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Costs indicated for task implementation and/or time for achievement of recovery are only estimates and subject to change. Recovery plans do not necessarily represent the views or the official positions or approval of any individuals or agencies involved in the plan formulation other than the U.S. Fish and Wildlife Service. They represent the official position of the U.S. Fish and Wildlife Service only after they have been signed by the Regional Director or Director as approved. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and completion of recovery tasks.

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EXECUTIVE SUMMARY

Current Species Status: The northern Idaho ground squirrel (Spermophilus brunneus brunneus) was federally listed as a threatened species on April 5, 2000 (65 FR 17779). This subspecies is known to exist only in Adams and Valley Counties of western Idaho. The entire range of the species is about 29 by 32 kilometers (18 by 20 miles), and currently contains 23 extant population sites. The species declined from about 5,000 individuals in 1985, to less than 1,000 by 1998, when it was proposed for listing under the Endangered Species Act of 1973, as amended. By the year 2000, surveys indicated only about 350 individuals remained in known population sites. Based on preliminary census data collected in the spring of 2001, the population was estimated to be 450 to 500 animals.

Habitat Requirements and Limiting Factors: The northern Idaho ground squirrel occurs in shallow, dry rocky meadows usually associated with deeper, well-drained soils and surrounded by ponderosa pine and Douglas-fir at elevations of about 1,150 to 1,590 meters (3,800 to 5,400 feet). It is a meadow and shrub/grassland dependent species that thrives in meadow habitat bordered by coniferous forests of older ponderosa pine and Douglas-fir. It is primarily threatened by habitat loss due to forest encroachment into former suitable meadow habitats. Forest encroachment results in habitat fragmentation, eliminates dispersal corridors, and confines the northern Idaho ground squirrel populations into small isolated habitat islands. The subspecies is also threatened by competition from the larger Columbian ground squirrel (*Spermophilus columbianus*), land use changes, recreational shooting, poisoning, genetic isolation and genetic drift, and random naturally occurring events.

Recovery Objective: The major objective of this plan is to restore habitat to support local populations of ground squirrels within a natural range of variation, restore dispersal corridors between populations, and provide valid management strategies that will allow the species to be delisted.

Recovery Priority Number: The recovery priority number for the northern Idaho ground squirrel is 3C on a scale of 1 to 18, indicating that it is: 1) taxonomically, a subspecies; 2) facing a high degree of threat; 3) rated high in terms of recovery potential; and 4) may be in conflict with construction and recreational development projects or other forms of economic activity.

Recovery Criteria: The subspecies will be considered for delisting when a total of 30 stable population sites are distributed throughout the historic range of the subspecies. Each population site that has maintained a 5-year average population size of 100 to 500 individuals will be considered stable and at least 20 of the 30 population sites must be protected sites. Additionally, genetic exchange between population sites should be occurring through dispersal or linkage corridors, a post-delisting monitoring program has been written and is ready to be implemented, and ecological management of habitats has been initiated for all population sites.

Actions Needed:

- 1. Protect and increase all extant population sites.
- 2. Protect suitable occupied and unoccupied habitat and dispersal corridors.
- 3. Fully implement habitat management prescriptions on the Payette National Forest.
- 4. Fully implement a long-term intensive and extensive population monitoring plan.
- 5. Conduct additional research to determine habitat use and population dynamics of the species.
- 6. Increase efforts to enhance the outreach program for conservation of the northern Idaho ground squirrel.
- 7. Develop a comprehensive database to be used for monitoring the success of recovery.

Recovery Actions to Date: Recovery actions include the development of a Conservation Agreement between the Payette National Forest and us in 1996, which was renewed in 2001. A 5-year Habitat Management Plan is being implemented by the Payette National Forest that restores linkage between population sites and higher quality foraging and burrow habitat. A comprehensive population monitoring program was started in 1999, by the Idaho Department of

Fish and Game and has continued through 2001. A Safe Harbor Agreement was finalized in 2000 with one landowner whose land supports northern Idaho ground squirrels. A 3-year dietary analysis was begun in 2000, to determine protein and lipid content of key forage plants, and supplemental feeding at four sites was begun in 2001, to determine the feasibility of increasing the weight of ground squirrels prior to torpor. Annual surveys for new population sites have been completed since 1994, and a new population site was found during the 2001 field season.

Critical habitat has not been designated for the subspecies.

Date of Recovery: Delisting could be initiated by 2016, if conservation measures produce positive responses at each population site and there is complete implementation of adaptive management strategies on Federal lands. Surveys, monitoring, and adaptive management through Conservation Plans or other agreements will be encouraged on private lands where known population sites occur.

Estimated Cost of Recovery: The estimated cost of recovery for delisting within a minimum of 15 years is approximately \$2.62 million, or about \$175,000 per year.

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I. INTRODUCTION

A. Overview

We (the U.S. Fish and Wildlife Service) listed the northern Idaho ground squirrel (*Spermophilus brunneus brunneus*) was listed under the Endangered Species Act of 1973, as amended, as a threatened species on April 5, 2000 (65 FR 17779). The recovery priority number for the species is 3C on a scale of 1 to 18, indicating that it is: 1) taxonomically, a subspecies; 2) facing a high degree of threat; 3) rated high in terms of recovery potential; and 4) may be in conflict with construction and recreational development projects or other forms of economic activity.

The northern Idaho ground squirrel is a relatively small member of the genus Spermophilus; the mean lengths of the male and female are 23.5 centimeters (9.25 inches) and 22.6 centimeters (8.9 inches), respectively (Yensen and Sherman 1997). The pelage (fur) of northern Idaho ground squirrels on the dorsal area appears dark reddish-gray as the result of a mixture of black unbanded and yellowish-redbanded guard hairs. The species eye ring is buffy-white (Figure 1). The northern Idaho ground squirrel has the most restricted geographical range of any Spermophilus species, and one of the smallest ranges among any North American mammal (Gill and Yensen 1992). The first specimens were collected in 1913 by L.E. Wyman, and described by A.H. Howell as a subspecies of the Washington ground squirrel (Citellus townsendii runneus) (Howell 1938). Subsequently, Howell (1938) reclassified the Idaho ground squirrel as a full species, Citellus brunneus. In 1949, Hershkovitz demonstrated that Spermophilus is the correct name for the genus. The systematics of Spermophilus brunneus were further supported by Nadler et.al. (1973) with chromosomal descriptions. Yensen (1991) further determined that Spermophilus brunneus consisted of two taxonomical subspecies (the northern Idaho ground squirrel, Spermophilus brunneus brunneus, and the southern Idaho ground squirrel, Spermophilus brunneus endemicus) based on morphology and life history differences, and biogeographical separation of the subspecies.



U.S. Fish and Wildlife Service 2000

Figure 1. Photo of the northern Idaho ground squirrel.

B. Status and Distribution

The distribution of the northern Idaho ground squirrel has become fragmented into what are now very small, isolated populations at 1,150 to 1,590 meters (3,800 to 5,400 feet) elevation in Adams and Valley Counties of west-central Idaho (Figures 2 and 3). Since about 1980, nine populations are known to have become extirpated (E. Yensen, Albertson College of Idaho, *in litt.* 2001). For example, the Mill Creek population located on Payette National Forest lands was extirpated in 1997, and the Lick Creek population on private land apparently went extinct in 1999 (P. Sherman, Cornell University, pers. comm. 1999).

There are 23 population sites now considered extant (Tables 1 and 2), although the status of a few of these has not been confirmed in the last couple years. Of these, 13 are on National Forest lands (Council and New Meadows Ranger Districts), 6 are on private lands, 2 are on both National Forest and private lands, 1 is on municipal property (in the town of Bear), and 1 occurs on private and State of Idaho land. For several years, population sites with the largest numbers of northern Idaho ground squirrels have been most closely monitored by researchers. These occur on the Payette National Forest and the privately-owned OX Ranch. Two population sites on the OX Ranch, Squirrel Manor and Squirrel Valley, are among the largest populations and have been monitored for the longest period of time. Sherman and Gavin (1997, 1999) documented the decline of the Squirrel Valley population from 120 individuals in 1987, to 10 in 1999, while Squirrel Manor had a population decline from 250 individuals in 1996, to fewer than 50 individuals in 1999. Moreover, each of four other population sites censussed between 1998 and 1999 declined markedly. The declines in 1999 may have been largely due to cold spring conditions (Sherman and Gavin 1999), whereas the longer-term declines may be related to declining habitat conditions. In general, long-term habitat fragmentation and population declines have resulted in small, isolated ground squirrel populations that appear to be prone to extinction due to naturally occurring factors. In 1985, the total northern Idaho ground squirrel population from 18 known population sites was approximately 5,000 squirrels (U.S. Fish and Wildlife Service 1985). A 2001 estimation, based on surveys, indicates there are approximately 450 to 500 northern Idaho ground squirrels in 23 population sites (Haak 2001).

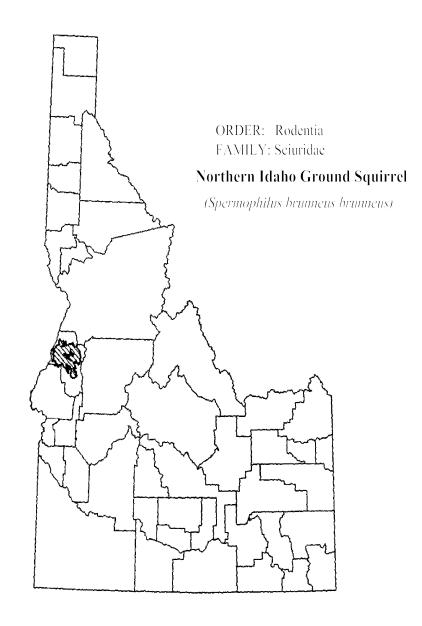


Figure 2. Range of the northern Idaho ground squirrel in western Idaho. (Fish and Wildlife Service 2001)



Figure 3. Northern Idaho ground squirrel population sites.

Table 1. Northern Idaho ground squirrel population sites in the Council Ranger District. Key population estimates are based on trapping and marking of adults and yearlings at intensive* monitoring sites in 1999-2001, and are based on extensive* monitoring on an annual basis at other sites. Where 1999-2001 data is not available, most recent population estimates (year of estimate) are provided.

Population Site	Population Complex	Population Estimate	Land Ownership ¹
Tree Farm	Summit Gulch	54+	F
Calf Pen	Summit Gulch	8+	F
Summit Gulch	Summit Gulch	41+	F
Cottonwood Corral	Cottonwood	6	F
Cottonwood II	Cottonwood	0	F
Cottonwood III	Cottonwood	0	F
Mill Creek	Cottonwood	extirpated	F
Chipmunk Springs	Cottonwood	40+	F
Halfway	Cottonwood	6+ (1998)	P
Rocky Comfort Flat	Paradise Flat	3+ (2001)	P
Riley Ranch	Paradise Flat	2+ (1996)	P/F
Squirrel Manor	Bear Creek	18+ (2001)	P
Bear Cemetery	Bear Creek	9 (1996)	M
Squirrel Valley	Bear Creek	6+ (2001)	P
Lick Creek	Bear Creek	extirpated	P
Huckleberry	Bear Creek	5	P/F
Cold Springs	Lick Creek Canyon	60+	F
Cold Springs East	Lick Creek Canyon	5+	F
Cold Springs West	Lick Creek Canyon	14+	F
Hoo Hoo Gulch	Lick Creek Canyon	10+	F
Fawn Creek	Lick Creek Canyon	4+	F
Roadside	Lick Creek Canyon	unknown	F
Greenwood	Hornet Creek	unknown	P
Greenwood II	Hornet Creek	unknown	P

 $^{^{1}}$ F is Federal, P is private, M is municipal, and S is State of Idaho. *See glossary.

Table 2. Northern Idaho ground squirrel population sites found in the New Meadows Ranger District. Key population estimates are based on trapping and marking of adults and yearlings at intensive* monitoring sites in 1999-2001, and are based on extensive* monitoring on an annual basis at other sites.

Population Site	Population Complex	Population Estimate	Land Ownership ¹
Slaughter Gulch Campground	Lost Valley	200+	F
Lost Lake	Lost Valley	3+	F
Lower Mud Creek	Mud Creek	extirpated	P
New Meadow	Mud Creek	3+	P
Ridgetop	Mud Creek	3+	P
Upper Mud Creek	Mud Creek	unknown	P
Price Valley -Mack	Price Valley	24+	P/S
Price Valley Guard Station	Price Valley	4+	F
Long Meadow	Price Valley	unknown	Р
Price Valley Road	Price Valley	extirpated	P
New Meadows	Little Salmon	extirpated	P
Van Wyck	Long Valley	extirpated	F
Cascade	Long Valley	extirpated	P
Herrick Corral	Round Valley	unknown	P
Sixty Lane	Round Valley	extirpated	Р
Wood's Corral	Round Valley	extirpated	P

 $^{{\}bf *See\ Glossary}.$

 $^{^{1}\,}$ F is Federal, P is private, M is municipal, and S is State of Idaho. *See glossary.

C. Habitat

Nearly all of the meadow habitats utilized by northern Idaho ground squirrels are bordered by coniferous forests of Ponderosa pine (*Pinus ponderosa*) and/or Douglas fir (*Pseudotsuga menziesii*). This ground squirrel is not abundant in meadows that contain high densities of small trees (Sherman and Yensen 1994). It is primarily graminivorous (feeds on grasses), similar to the Columbian ground squirrel (Dyni and Yensen 1996), and ingests large amounts of bluegrass (*Poa* sp.) and other grass seeds to store energy for the winter. The northern Idaho ground squirrel consumes at least 45 to 50 plant species (Dyni and Yensen 1996). Roots, bulbs, leaf stems, and flower heads are evidently minor components of their diet. It often inhabits areas with sparser vegetation than the Columbian ground squirrel (Dyni and Yensen 1996) (Figures 4 and 5). Such areas likely contain less abundant food resources than habitats occupied by Columbian ground squirrels (Belovsky and Schmitz 1994).

D. Life History and Ecology

The northern Idaho ground squirrel emerges in late March or early April and remains active above ground until July or early August (Yensen 1991). Emergence during this period begins with adult males, followed by adult females, and then yearlings. The northern Idaho ground squirrel becomes reproductively active within the first 2 weeks of emergence (Yensen 1991). Females that survive the first winter live, on average, nearly twice as long as males (3.2 years for females and 1.7 years for males). Individual females have lived for as long as 8 years. Males normally die at a younger age due to behavior associated with reproductive activity. During the mating period, males move considerable distances in search of receptive females and often fight with other males for copulations, thereby exposing themselves to predation by raptors, such as the prairie falcon (Falco mexicanus), goshawk (Accipiter gentilis), and red-tailed hawk (*Buteo jamaicensis*). Significantly more males die or disappear during the 2-week mating period than during the rest of the 12 to 14 week period of aboveground activity (Sherman and Yensen 1994). Seasonal torpor or hibernation generally occurs in early to mid-July for males and females, and late July to early August for juveniles.



U.S. Fish and Wildlife Service

Figure 4. Summit Gulch population site after a controlled burn (1999).



U.S. Fish and Wildlife Servive

Figure 5. Summit Gulch population site 2 years after the controlled burn (2001).

The northern Idaho ground squirrel often digs burrows under logs, rocks, or other objects (Sherman and Yensen 1994). Dry vegetation sites with shallow soil horizons of less than 50 centimeters (19.5 inches) depth above bedrock are preferred to develop burrow systems (Yensen *et al.* 1991). Burrows associated with shallow soils are called auxiliary burrows. Nesting burrows are found in deeper soil pockets that are greater than 1 meter (3.28 feet) deep, and are usually located near the tops of slopes. Although Columbian ground squirrels (*Spermophilus columbianus*) overlap in distribution with the northern Idaho ground squirrel (Dyni and Yensen 1996), Columbian ground squirrels prefer moister areas with deeper soils. Sherman and Yensen (1994) reported that the segregation of the two species is due to competitive exclusion as opposed to differing habitat requirements.

E. Population Dynamics

As a result of the factors described in the Life History and Ecology section, and due to the small sizes of the remaining population sites, the northern Idaho ground squirrel may have little resilience to naturally occurring events. Small animal populations are often vulnerable to climatic fluctuations and catastrophic events (Mangel and Tier 1994). In 1993, Gavin ran a computer population viability simulation program (VORTEX) using recruitment and death values recorded over 8 years from an intensively studied northern Idaho ground squirrel population site (Gavin et.al. 1999; Sherman and Yensen 1994). Variables in the model included no natural immigration, and began the population viability analysis using 50 individuals, a figure that was 30 individuals lower than the actual population size of 80 individuals (Sherman and Yensen 1994). The model calculated that all but 1 of 100 population sites would become extinct in less than 20 years. We contracted with Michael Runge, U.S. Geological Survey-Patuxent Wildlife Research Center, to develop a population model for the northern Idaho ground squirrel (1999). The program is designed to allow the user to develop population projections for a population site or population complex using data collected about the demographic structure over 3 or more years. Currently, we are in the data collection phase, but will have sufficient data by the end of the 2001 field season to synthesize data on both private and public lands in order to facilitate discussion of potential recovery strategies and scenarios.

F. Reasons for Decline

1. Present or threatened destruction, modification, or curtailment of habitat or range. The fragmented distribution of the northern Idaho ground squirrel is a remnant of what may once have been a more continuous distribution from Round Valley, Valley County, north to New Meadows, and southwest to Council in Adams County, Idaho. All remaining habitat sites for this ground squirrel are small in relation to those of other species of ground squirrels, ranging from 1.2 to 16 hectares (3 to 40 acres), and all are threatened by one or more of the following: forest encroachment into grassland meadows, conversion to agriculture, residential construction, development of recreational facilities such as golf courses, and road construction and maintenance.

The primary threat to the northern Idaho ground squirrel is meadow invasion by conifers (Sherman and Yensen 1994). Fire suppression and the dense regrowth of conifers resulting from past logging activities have significantly reduced meadow habitats suitable for these ground squirrels over the past 40 years. As the amount of suitable meadow habitat on public and private lands has been reduced, northern Idaho ground squirrel dispersal corridors have been reduced or eliminated, further constricting the species into smaller isolated areas (Truska and Yensen 1990). The loss of dispersal corridors has caused some isolated population sites to become extirpated in recent years (Sherman and Yensen 1994; U.S. Fish and Wildlife Service 1996). Additionally, small populations at several remaining sites are likely to become extirpated (Sherman and Yensen 1994; Mangel and Tier 1994). Fire suppression has allowed conifers to invade once suitable meadow habitats, thereby shrinking the size of forb/grass meadows or closing grassy dispersal/migration corridors entirely to nearby meadow sites. These changes have isolated the dry meadows with suitable shallow soils and preferred forage and burrow habitat where the northern Idaho ground squirrel finds refuge from the Columbian ground squirrel. Habitat fragmentation and reduced opportunities for dispersal among habitats prevents gene flow and results in considerable population differences (Sherman and Yensen 1994).

For the past 70 years, agricultural conversion and rural housing developments near the communities of Round Valley, New Meadows, and Council, Idaho have fragmented suitable habitat formerly occupied by the northern Idaho ground squirrel.

During this time, extensive use of pesticides may have reduced the range and population of northern Idaho ground squirrels (Stoddard 2001). Various other types of developments continue to threaten remaining occupied sites in Adams and Valley Counties. Following completion of a golf course and associated housing development, ground squirrels were eradicated due to their impacts to the fairways and golf greens (Yensen 1985).

A 51.6 kilometer (32 mile) gravel road from Council to Cuprum, Idaho, is scheduled to be paved in the year 2002 (U.S. Department of Transportation 1998). Approximately 6.5 kilometers (4 miles) of this project runs through historic and currently occupied habitat of the northern Idaho ground squirrel. The project will also extend seasonal vehicle access to four occupied population sites, which may subject northern Idaho ground squirrels to increased mortality risk from higher speeds of vehicular traffic. Recreational shooting from the road may be another threat. A mitigation plan has been developed for the Council to Cuprum Road paving project, with cooperation from the Federal Highways Administration (U.S. Forest Service 1997). The plan identifies mitigation actions to attract northern Idaho ground squirrels away from the paved highway and toward adjacent but suitable habitat. Funding for this plan allows for monitoring mitigation measures for a 3-year period after the road improvements have been made. It is uncertain whether proposed mitigation measures are satisfactory in protecting remaining populations in the vicinity of the road improvement project.

Currently, there is local interest in enlarging the dam and pool size of the Lost Valley Reservoir from 1,233.5 hectare/meters to 3,700.5 hectare/meters (10,000 acre/feet to 30,000 acre/feet) for irrigation. If this expansion occurs, it would likely flood key habitat currently occupied by northern Idaho ground squirrels at Slaughter Gulch, the largest known population site. This action would require section 7 consultation because Federal land managed by the Payette National Forest would be flooded, necessitating the acquisition of a special use permit.

Some activities or lack of management practices on private property appear to pose a threat to northern Idaho ground squirrels. Of the 23 population sites at which northern Idaho ground squirrels are known or presumed to be extant, 6 are entirely on private property and 2 are on both private and Federal property. Of these, four are on

property owned by the OX Ranch. Grazing practices could adversely affect northern Idaho ground squirrel habitat on some State and private lands. Implementing management or survey activities for northern Idaho ground squirrels requires cooperation from private landowners; continued resistance may adversely affect the species. Controlled burning, a factor crucial to the continued survival and recovery of northern Idaho ground squirrels, is often difficult to implement on private lands. One issue concerns liability if a controlled fire burned beyond its intended limits. Another is that access by agency biologists or researchers to monitor population sites and to implement habitat restoration activities is often denied on private lands.

- 2. Overutilization for commercial, recreational, scientific, or educational purposes. Recreational shooting has contributed to the decline of northern Idaho ground squirrels at various recreation sites (Yensen 1985). Sites adjacent to housing developments, farms, or roads in particular, are subject to a high rate of recreational shooting. Four incidents of shooting northern Idaho ground squirrels have been documented (E. Yensen, pers. comm. 1999). Scientific collection of ground squirrels could also adversely impact this species; however, less than 30 were taken during the past 20 years for museum collections. More recently, no known mortality of northern Idaho ground squirrels has occurred through live-trapping and relocation studies by research scientists handling, weighing, or temporarily marking over 1,100 squirrels (Sherman and Yensen 1994; Haak 2000).
- 3. <u>Disease and predation</u>. Disease is not thought to be a major factor affecting the northern Idaho ground squirrel. The parasitic nematode (*Pelodera strongyloides*) infects the eyes of the northern Idaho ground squirrel (Sherman and Yensen 1994). This eye worm is not currently known to be a cause of mortality in existing populations (Yensen *et al.* 1996). Plague (*Yersina pestis*), a contagious bacterial disease in rodents, has not yet been found in any northern Idaho ground squirrel populations (Yensen *et al.* 1996). The disease, once established, could decimate squirrel populations. Blood analysis to determine whether pandemic (widespread) diseases are present has not been done on the northern Idaho ground squirrel.

The primary predators of the northern Idaho ground squirrel include badger (*Taxidea taxus*), northern goshawk (*Accipiter gentilis*), prairie falcon (*Falco mexicanus*) and occasionally red-tailed hawks (*Buteo jamaicensis*). Predators may

threaten many of the smaller, more isolated population sites of this ground squirrel. Badger activity has been noted at several of these sites (Sherman and Gavin 1997; Haak 2000; Haak 2001; L. Bangerter, Wildlife Services, pers. comm. 2001). Badgers are efficient predators and could potentially eliminate a small population in just a few days. Male ground squirrels, due to their above-ground behavior patterns, are particularly vulnerable to predation during the mating season. Juveniles are subject to a high degree of predation during their first year (Sherman and Yensen 1994).

4. <u>Inadequacy of existing regulatory mechanisms</u>. The State of Idaho recognizes the northern Idaho ground squirrel as a Species of Special Concern (Idaho Department of Fish and Game 1992). Because of this status, the northern Idaho ground squirrel is protected from taking (*i.e.*, shooting, trapping, and poisoning) or possession by State law. To date, however, protection from recreational shooting has not been adequately enforced by the State of Idaho and the northern Idaho ground squirrel remains vulnerable to this type of activity (Yensen 1985). In 1997, the Idaho Department of Fish and Game classified the northern Idaho ground squirrel as a Protected Nongame Species, making it illegal to collect, harm, or otherwise remove from its natural habitat.

Local land use ordinances and other regulations are inadequate in the protection of this species. For example, in 4 of 23 existing population sites of the northern Idaho ground squirrel in Adams County, land use regulations allow for single and multiple housing development under a permit system. There is no consideration under the permit system for impacts to northern Idaho ground squirrels from housing or recreation developments in or adjacent to their habitat. With no limitations on development, it is anticipated that future human population growth and development will eliminate some existing ground squirrel population sites.

5. Other natural or manmade factors affecting continued existence. Other factors affecting the conservation of this species include land ownership patterns, prelisting activities, and existing conservation efforts on private and public lands. Habitat and resource competition with the Columbian ground squirrel affects the northern Idaho ground squirrel. Competitive exclusion of forage and behavioral displacement by the Columbian ground squirrel are known to cause local population declines of the northern Idaho ground squirrel (Dyni and Yensen 1996). The northern

Idaho ground squirrel may have been forced into areas containing shallower soils due to competition from Columbian ground squirrels (Sherman and Yensen 1994). The Columbian ground squirrel is larger and prefers areas with deeper soils that provide better over-winter protection and higher nutrients, however it is not restricted by soil depth. Typically their burrow systems are associated with well-drained soils and a higher number of native forbs.

Winter mortality may be a contributing factor of northern Idaho ground squirrel decline, especially when juvenile squirrels enter hibernation without sufficient fat reserves. Soils also tend to freeze to greater depths where snow levels are insufficient. When this occurs, northern Idaho ground squirrels are unable to thermoregulate or maintain sufficient fat reserves. Although the relationship between ground squirrels and weather is complex (Yensen *et al.* 1992), population sites may have been adversely affected by drought and over-winter mortality in the early 1990's. Winter mortality is of special concern since many remaining sites contain few individuals. High winter mortality combined with loss of suitable vegetation conditions can result in the permanent loss of isolated populations.

G. Conservation Measures

1. Federal Programs. Section 7(a) of the Endangered Species Act requires Federal agencies to evaluate their actions with respect to any species that is proposed or listed as endangered or threatened and with respect to its critical habitat, if designated. Federal agencies are required to ensure that any activity they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or to destroy or adversely modify its critical habitat. If a Federal action may affect a listed species or its critical habitat, the responsible agency must enter into formal consultation with us. Extant populations of northern Idaho ground squirrel found on Federal land are managed by the Payette National Forest, and historical populations were present on the Boise National Forest. In addition, sections 2(c)(1) and 7(a)(1) of the Endangered Species Act require Federal agencies to utilize their authorities in furtherance of the purposes of the Endangered Species Act to carry out conservation programs for endangered and threatened species.

All other extant populations of northern Idaho ground squirrels are located on lands owned by the State of Idaho, a municipality, or by private landowners. However, projects authorized or funded by various Federal agencies, or requiring federal permits could affect the species and are subject to section 7 consultation. Such federally funded projects, including road construction or maintenance and habitat enhancement projects for northern Idaho ground squirrels and other rare species, are subject to section 7 review.

A cooperative agreement between us and U.S. Department of Agriculture, Wildlife Services was signed on June 29, 2001, to provide predator control relief to key populations of northern Idaho ground squirrels. This short-term agreement expired on September 31, 2001. We expect to develop another long-term agreement with USDA Wildlife Services, Idaho Department of Fish and Game, and the Payette National Forest that will provide for predation control at essential population sites and complexes.

A conservation agreement was finalized in July 1996, between us and the Payette National Forest with a duration of 5 years (U.S. Fish and Wildlife Service 1996). The agreement identifies conservation and land management actions that will

provide habitat favorable to the northern Idaho ground squirrel. These actions, some already in the implementation phase, include controlled burning of selected meadows to reduce overstory and to improve forage preferred by the northern Idaho ground squirrel, timber harvest in select areas to open meadows where active population sites are found, and timber harvest to provide dispersal corridors for improved connectivity between active populations (U.S. Forest Service 2000). For example, 3.3 million board feet of timber is proposed for harvest in Lick Creek drainage during the next 5 years. The sale is designed to reconnect an active population site with other nearby population sites. It will also expand the size of 12 unoccupied meadow habitats on Federal lands that are favorable to recolonization by the northern Idaho ground squirrel.

In 2000, we funded a 3-year study to determine the protein and lipid content of northern Idaho ground squirrel key forage plants. Additionally, a supplemental feeding program was initiated in 2001 to determine the feasibility of increasing the weight of northern Idaho ground squirrels prior to hibernation.

Since 1994, the Idaho Department of Fish and Game, through section 6 funding, has monitored key population sites and conducted surveys for additional population sites on an annual basis. A new population site was located in 2001.

Long-term monitoring efforts are expected to continue for the duration of recovery efforts. Annual monitoring reports are published.

A safe harbor agreement, authorized under section 10 of the Endangered Species Act, was finalized in 2000, and covers 1.67 of 4.68 hectares (5 of 14 acres) of one private land parcel (U.S. Fish and Wildlife Service 2000b). This has allowed us to apply various conservation actions to maintain ground squirrels at the Price Valley-Mack population site. The agreement remains in effect for 20 years and expires on September 17, 2020.

2. <u>Non-Federal Programs</u>. A reintroduction plan, developed by scientists from Cornell University in Ithaca, New York, and Albertson College of Idaho in Caldwell, Idaho, was initiated in the spring of 1997, and continued in 1998. A total of 76 northern Idaho ground squirrels were transplanted to 2 sites that had been treated

through burning and timber harvest (Sherman and Gavin 1997; Gavin *et al.* 1998). Both treated sites are on lands managed by the U.S. Forest Service and were selected because they have recently supported northern Idaho ground squirrels. Initial results indicated that some translocated females were lactating and juveniles were observed at both sites (Sherman and Gavin 1997; Gavin *et al.* 1998). However, relocation of northern Idaho ground squirrels produced negative results at the Cottonwood Corrals population site, possibly due to low population numbers or predators. Results at the Summit Gulch population site have been positive. Long-term benefits from these relocations will not be known for several years.

II. RECOVERY

A. Recovery Plan Objective and Strategy

The ultimate goal of this recovery plan is to improve the status of the northern Idaho ground squirrel so that the species can be delisted. The subspecies should be eligible for delisting consideration when breeding populations of the northern Idaho ground squirrel are self-sustaining at 30 or more population sites.

The first step toward recovery of the northern Idaho ground squirrel is to protect and manage the 23 known extant population sites and their surrounding habitat. This will depend on developing successful partnerships with public land managers and private landowners. On public lands, this will entail working with the Payette National Forest, Idaho Department of Fish and Game, and USDA Wildlife Services through cooperative conservation agreements and section 7 of the Endangered Species Act. On privately owned lands, this means working through existing programs such as section 10(a) permits, conservation easements, management agreements, land acquisition, and other approaches.

Recovery also requires establishing new populations and, where space and habitat allow, increasing the area occupied at existing population sites. At present, the number of extant population sites, the number of individuals in each population site, and the amount of area occupied by each population site are extremely small. These factors may make the species particularly vulnerable to random environmental events that could induce local extirpation of a population site or complex within 1 or 2 years.

Another aspect of recovery is continued inventory efforts. Since the northern Idaho ground squirrel currently occurs in small, isolated populations, it is possible that additional population sites exist on privately owned lands that have not been surveyed and that are not visible from any points of public access. It is recommended that additional inventory efforts be concentrated on private lands whenever possible.

Research and monitoring are also key elements of the recovery strategy.

Monitoring the status and trends of existing population sites should continue.

Research needs to focus on determining variables that influence the distributional

pattern and population dynamics of northern Idaho ground squirrels, and on establishing and maintaining new, viable populations at appropriate sites to meet the goals of this recovery plan. Studies needed to understand more throughly the survival and habitat requirements of the species include: determining the feasibility of establishing supplemental feedings at known population sites, fertilization of vegetation to increase forage production, determining the appropriate livestock grazing periods and stocking rates for maintaining vegetation condition suitable for northern Idaho ground squirrels, determining prescribed burning regimes that will maintain and enhance forage capability of the habitat, determining timber harvest levels that will lead to increased habitat and connectivity, and development of formal protocol standards for population and plant composition monitoring. An artificial propagation program to augment existing northern Idaho ground squirrel population sites and to start new population sites at improved habitat areas may also be necessary.

B. Recovery Criteria

Due to the very restricted geographic range and low population size, the existing population must first be stabilized and then increased. The recommended criteria are to provide sufficient habitat to maintain stable populations of northern Idaho ground squirrels, never fluctuating below a total of about 3,500 individuals, distributed throughout Adams and Valley Counties in Idaho. Once the populations have been stabilized, delisting may then be considered when all of the following conditions have been met:

- 1. Stable populations of northern Idaho ground squirrels occur at 30 or more population sites distributed throughout the historic range of the species. To be deemed stable, a population must maintain a 5-year average population size of at least 100 to 500 individuals or more.
- 2. At least 20 of the 30 population sites are 'protected' sites. In order for a site to be deemed protected, it must be either owned and/or managed by a government agency or private conservation organization that identifies maintenance of the species as the primary management objective for the site, or the site must be protected by a permanent conservation easement or covenant that commits present and future landowners to the conservation of the species.

- 3. Genetic exchange between population sites is occurring through dispersal or linkage corridors.
- 4. A post-delisting monitoring program of individual population sites has been written and is ready to be implemented through a Federal or State program.
- 5. Post-delisting procedures for the ecological management of habitats for all population sites have been initiated.

C. Date of Recovery

Delisting could be initiated by 2016, if conservation measures produce positive responses at each population site and there is complete implementation of adaptive management strategies on Federal lands. Surveys, monitoring and adaptive management through Conservation Plans or other agreements will be encouraged on private lands where known population sites occur.

III. STEP-DOWN NARRATIVE FOR RECOVERY ACTIONS

- 1.0 Maintain and enhance existing northern Idaho ground squirrel population sites in their present habitats. Populations of northern Idaho ground squirrels occur in Adams and Valley Counties, Idaho. The primary thrust of the recovery effort should be protection and maintenance of known population sites. Monitoring should be an integral part of any enhancement activities.
 - 1.1 Implement actions to protect and enhance known northern Idaho ground squirrel population sites on National Forest lands. The Payette National Forest should amend their Land and Resources Management Plan to include tasks recommended in the recovery plan. Actions taken in northern Idaho ground squirrel habitat by the Payette National Forest may require section 7 consultation with us. Section 7 consultation on the Boise National Forest may be necessary if northern Idaho ground squirrel population sites are found within its area of jurisdiction (see Task 2.0).
 - 1.1.1 Amend the Payette National Forest Land and Resources

 Management Plan. The Land and Resource Management Plan
 for the Payette National Forest should be amended to provide
 continued protection of known northern Idaho ground squirrel
 habitats, rehabilitation of potential habitats, and long-term
 monitoring of populations and habitat.
 - 1.1.2 Implement road closures and other restrictions to protect known northern Idaho ground squirrel population sites.

 Signs, road closures, restrictions, and other measures will provide mechanisms to limit disturbance to northern Idaho ground squirrels and their habitat.
 - **1.1.3 Develop site specific management plans for known population sites.** The Payette National Forest should develop site specific management plans for each population site or population complex. These management plans should address

eliminating or reducing threats at population sites on National Forest lands. For example, the Payette National Forest, in consultation with us, should review stocking rates and seasonal use of forage by livestock at northern Idaho ground squirrel population sites on National Forest Lands, and develop management plans to address this potential threat.

- 1.1.4 Review and renew the conservation agreement between the Payette National Forest and the U.S. Fish and Wildlife Service. A conservation agreement between the Payette National Forest and us was signed in 1996, and renewed in 2001. The success of this agreement should be reviewed and updated every 5 years.
- 1.2 Monitor results of the Federal Highway Administration mitigation plan. A mitigation plan was developed for the Council to Cuprum Road paving project in cooperation with the Federal Highway Administration and the U.S. Forest Service. Actions in the plan included attracting ground squirrels away from the paved highway and toward adjacent suitable habitat to avoid vehicles. The effects of these efforts are unknown and will require monitoring for a minimum of 3 years.
- 1.3 Implement actions to protect known northern Idaho ground squirrel population sites on State of Idaho, municipal, and private lands. Several known northern Idaho ground squirrel population sites occur on non-Federal lands. Efforts should focus on cooperative actions to protect and enhance existing population sites on these lands.
 - 1.3.1 Seek the cooperation of State of Idaho, private and municipal landowners to protect known northern Idaho ground squirrel population sites. Efforts should be made to seek the cooperation of State, municipal, and private landowners where known population sites area located. Cooperation should provide for the conservation of habitat and allow access and

experimental habitat manipulation for study and monitoring (see tasks below for monitoring). Various means to protect northern Idaho ground squirrel habitat can be utilized, including seeking conservation easements, development of management plans and habitat conservation plans, revision of land use regulations to protect habitats, and other voluntary or permitted conservation actions.

- 1.3.2 Monitor the success of the Safe Harbor Agreement on private lands. A safe harbor agreement, authorized under section 10 of the Endangered Species Act, was finalized in 2000, and covers 1.67 of 4.68 hectares (5 of 14 acres) of one private land parcel (U.S. Fish and Wildlife Service 2000b). This has allowed us to apply various conservation actions to maintain ground squirrels at the Price Valley-Mack population site. The agreement remains in effect for 20 years and expires on September 17, 2020. Monitoring of the agreement should be part of an overall monitoring effort (see Task 9.1).
- 2.0 Establish a central database for information regarding the northern Idaho ground squirrel. A central database should be established that contains information regarding the location of existing and any additional population sites found. Past records of northern Idaho ground squirrels should be collected and organized. Records should be entered on quadrangle and geographic information system maps, and keyed to supporting narrative data. Narrative data should include as much information as possible concerning field conditions, observers, dates, times, numbers and gender of squirrels, pertinent biological correlates, and the type of observation. These records and the geographic information system habitat maps should be updated regularly. An effort should be made to conduct a sensitivity analysis using the data collected.
- 3.0 Identify additional northern Idaho ground squirrel population sites on Federal and non-Federal lands. Some areas in and surrounding the historic range of northern Idaho ground squirrel have not been surveyed consistently for additional population sites. All additional sites should be added to the central database described in Task 2.0.

- **3.1.** Develop and implement a program to systematically search for additional population sites. Using existing population site information, a program to systematically search for additional population sites on Federal and non-Federal lands should be developed.
- **3.2 Develop a reporting system for additional northern Idaho ground squirrel population sites found.** Procedures (for use by trained observers) for reporting squirrel sightings should be developed. Information to be reported should include date, time, name and address of observer, location of sighting, type of sighting (*i.e.*, live animal or roadkill), and other pertinent information. Information gathered should be maintained in the central database described in Task 2.0.
- **4.0 Develop, evaluate, and update a public education and outreach program and materials for northern Idaho ground squirrel recovery.** Due to the reduction in northern Idaho ground squirrel numbers associated with loss of habitat and recreational shooting, an information and education program should be developed. This program should provide information regarding conservation of the northern Idaho ground squirrel and its habitat, and should be made available to all landowners with known habitat, field personnel of the Idaho Department of Fish and Game, local schools, and other interested parties.
 - 4.1 Implement a program to provide education and public outreach for northern Idaho ground squirrel recovery. We, in cooperation with the Payette National Forest and Idaho Department of Fish and Game, will develop a comprehensive media guide about the northern Idaho ground squirrel through the use of the world wide web, video, posters, and identification guides. Existing resources, such as the portable museum display of northern Idaho ground squirrels and Columbian ground squirrels should be part of this effort.
 - **4.2** Inform adjacent landowners of northern Idaho ground squirrel population sites nearby. On both Federal and private lands, U.S. Fish and Wildlife Service, Payette National Forest, and Idaho Department of

Fish and Game should seek cooperation of landowners whose property is adjacent to existing population sites. If adjacent habitat is being utilized by northern Idaho ground squirrel or has the potential to be utilized, appropriate cooperative agreements or land trades should be initiated.

- Enforce existing State of Idaho and federal protections for the northern Idaho ground squirrel. The northern Idaho ground squirrel is protected under Federal and State of Idaho laws. Enforcement of these laws is our responsibility that of the Idaho Department of Fish and Game, in cooperation with the Payette National Forest. Possible violations and interagency assistance and coordination should be identified and communicated through the involved agencies. Agencies or groups with actions within the range of present or proposed northern Idaho ground squirrel populations must be informed of the subspecies' status and habitat so that unintentional infractions of laws or inadvertent destruction of individuals or habitats do not occur. Similarly, agencies should be encouraged to incorporate conservation actions for the northern Idaho ground squirrel into their planned activities. Section 7 consultation requirements must be pointed out to all Federal agencies supporting actions that may impact the species or its habitat.
- 6.0 Determine life history parameters, population structure, distribution patterns and population trends. To understand important characteristics of northern Idaho ground squirrel habitat, distribution, and population structure and trends, information regarding existing population sites and habitat should be gathered. A reliable population viability analysis model requires specific information yet to be determined. Data is also needed to determine more clearly the limiting factors for northern Idaho ground squirrel recovery, an understanding of the interactions between Columbia ground squirrels and northern Idaho ground squirrels, and information regarding habitat use and productivity among different vegetation associations. We contracted with Michael Runge, U.S. Geological Survey-Patuxent Wildlife Research Center, to develop a population model for the northern Idaho ground squirrel (1999). The program is designed to allow the user to develop population projections for a population site or population complex using data collected about the demographic structure over 3 or more years.

- 6.1 Determine and gather information necessary to complete a population viability analysis for the northern Idaho ground squirrel. Currently, we are in the data collection phase but will have sufficient data by the end of the 2001 field season in to synthesize data on both private and public lands, which will facilitate discussion of potential recovery strategies and scenarios.
- 6.2 Use information gathered through Task 6.1 to determine the status of the northern Idaho ground squirrel and refine recovery goals.
- 6.3 Conduct research regarding the interspecific interactions between the Columbia ground squirrel and northern Idaho ground squirrel. Research into possible competitive interaction with the Columbian ground squirrel is necessary to determine if northern Idaho ground squirrels are being excluded from some habitats, or if competition for food resources is depressing their numbers. If significant competition is found, control of Columbian ground squirrels should be considered.
 - **6.3.1 Establish and implement a program to control Columbian ground squirrels.** If it is determined that Columbia ground squirrels are excluding northern Idaho ground squirrels from otherwise desirable habitats (Task 6.3), a program to control Columbia ground squirrels should be established and implemented.
- 6.4 Identify northern Idaho ground squirrel predation rates and if significant, implement a control program to promote recovery.

 Sources of possible predation and predation rates should be identified at northern Idaho ground squirrel population sites that are determined to be important for recovery.
 - **6.4.1 Establish a predator control program.** Based on the information gathered in Task 6.4, a predator control program should be formulated and established that considers feasibility and northern Idaho ground squirrel recovery potential.

- **6.4.2** Renew agreement to implement a predator control program. If it is determined to be feasible and necessary for recovery of the northern Idaho ground squirrel, implement a predator control program. This program can be established through renewal of the cooperative agreement between USDA Wildlife Services and us.
- 6.5 Perform contaminants analysis on northern Idaho ground squirrel carcasses. Within the historic range of the northern Idaho ground squirrel are forest and agricultural lands where pesticides may have been applied to control rodents. It is possible that pesticides and other chemicals have an effect on northern Idaho ground squirrel. Procedures should be devised for collecting and analyzing carcasses for selected contaminants based on Task 9.3.
- 7.0 Restore populations of northern Idaho ground squirrels into suitable areas of their former occupied range. A reintroduction plan was initiated in the spring of 1997, and continued in 1998. A total of 76 squirrels were transplanted to two sites that had been treated through burning and timber harvest. Both treated sites are on lands managed by the U.S. Forest Service and were selected because they have recently supported northern Idaho ground squirrels. Initial results indicated that some reintroduced females were lactating and juveniles were observed at both sites. However, relocation of squirrels produced negative results at the Cottonwood Corrals population site, possibly due to low population numbers or predators. Results at the Summit Gulch population site have been positive. Long-term benefits from these relocations will not be known for several years. Prior to additional efforts to reintroduce northern Idaho ground squirrels into areas of their former range, the areas should be surveyed throughly for the presence of unknown populations of northern Idaho ground squirrels and for population site suitability based on the present knowledge of their requirements. Long-term management should be established for any reintroduced population. The reestablishment of northern Idaho ground squirrel populations will greatly enhance their prospects for long-term survival.

- 7.1 Identify and enhance suitable habitat for additional population sites. Sites within the historic range of northern Idaho ground squirrel should be surveyed for existing populations and for suitability for northern Idaho ground squirrels. These sites should be enhanced by use of management tools, such as vegetation manipulation.
- 7.2 Develop management plans for each potential reintroduction site.

 Management plans should be prepared for all reintroduction sites tentatively suitable for northern Idaho ground squirrel transplants. The plans should be detailed enough to recommend specific management practices to enhance and conserve northern Idaho ground squirrel habitat. Preparation of plans should begin as soon as appropriate sites are identified and should be finished before northern Idaho ground squirrels are introduced.
 - **7.2.1 Manage restored habitat for reintroduction sites.** Restored habitats should be managed similarly to existing habitats for known population sites.
- 7.3 Establish release protocol for reintroducing northern Idaho ground squirrels into appropriate sites. Reintroduction protocol should define the characteristics and minimum size of source populations for reintroduction, the characteristics and minimum number of northern Idaho ground squirrels per release, and the number of reintroductions necessary to maintain a population site. As information is gained through other recovery tasks, requirements will be further specified, and the release protocol will be modified accordingly.
 - **7.3.1** Reintroduce the northern Idaho ground squirrel into managed sites. Northern Idaho ground squirrels can be introduced as soon as a suitable site has been identified, the necessary enhancement has been performed, and a management plan has been approved.

- **7.3.2 Monitor reintroduced northern Idaho ground squirrels and habitat.** After northern Idaho ground squirrels have been reintroduced, each population site must be monitored to determine success. Monitoring should include established reintroduction sites referenced above, and should be incorporated into actions described in Task 8.0.
- 7.3.3 Continue reintroductions at each population site for up to 5 years. Monitor and evaluate reintroduced populations to determine if they are self-sustaining, or until a decision is made to abandon the site.
- 8.0 Develop a captive breeding plan. Information gathered during monitoring and research would be used to determine if a supplemental captive breeding program should be established. This analysis would need to include staffing requirements, annual operation costs, and propagation objectives. Implementation of a captive breeding plan should only be used to augment reintroduction sites or existing population sites. This may bring about a more rapid recovery and provide for genetic variability among population sites and complexes. A team of scientific experts should be assembled to review and develop a potential captive breeding program.
- 9.0 Evaluate and monitor existing northern Idaho ground squirrel population sites to assess the status of the species. Population monitoring provides a means of assessing the status of the species and feedback on the success of management programs. Little is known about annual fluctuations in Adams and Valley Counties and a database is essential to further management. In order to establish the long-term database described in Task 2.0, it is important to monitor a sample of the population sites each year. Monitoring should consider any new population sites, including reintroduced populations, and should assess the health and conditions of individual animals. A procedure for handling dead northern Idaho ground squirrel specimens should be developed.

- 9.1 Develop and implement a program to monitor northern Idaho ground squirrel population sites. A systematic program to monitor existing and, where applicable, new and reintroduced population sites should be developed and implemented. The number of population sites and frequency of monitoring should be included in monitoring protocols. April through July surveys, including live-trapping sessions (*i.e.*, mark/recapture), should be the major tools used for monitoring. These surveys should include: the number of animals in each population site, select habitat attributes, and any other details important for assessing northern Idaho ground squirrel status and recovery. Information gathered should be maintained in the central database described in Task 2.0.
- 9.2 Assure the adequacy of training of individuals conducting monitoring. In order to reduce the effects of handling of animals and the potential spread of diseases, persons engaged in routine population monitoring should be trained to perform an external veterinary examination of every animal they handle. The examination protocols should be patterned after those used by our veterinary personnel or those of the Center for Disease Control.
- 9.3 Implement a procedure for handling and disposition of road-killed or other deceased specimens of northern Idaho ground squirrel. This procedure should be developed in conjunction with Patuxent Wildlife Research Center and the National Wildlife Disease Laboratory to maximize the amount of information obtained from each animal and ensure preservation of specimens at appropriate repositories.
- 10.0 Additional research needs. The environmental correlates of areas now occupied by northern Idaho ground squirrels should be analyzed statistically. Efforts should be made to determine summer foraging and winter hibernation areas. Land use patterns should be examined to determine their effects on northern Idaho ground squirrel populations. All types of land use effects should be evaluated, including mining, grazing, timber management, burning, cultivation, highway construction, and residential, recreational, and utility uses.

The evaluation should include experimental studies where necessary. The role of succession in northern Idaho ground squirrel habitat should be examined. Because of the experimental nature of these studies and because of variation in weather patterns, these studies should be long-term. Five to 10 years should be the minimum period used to evaluate effects of experimental manipulations. During the first year, populations should be estimated and environmental correlates should be determined and analyzed. Experiments should be set up with priorities given to the effects of grazing, burning, and succession. Much of the data gathered by the monitoring personnel should be directly applicable to this phase of the study.

- 10.1 Develop and implement a program to address additional research needs. Additional research needs could include understanding the optimal elevations necessary for over-winter survival; monthly and annual precipitation and temperature cycles as indications of site suitability for long-term survival; optimal vegetation composition of population sites; and effects of soil characteristics and aspect on winter survival of northern Idaho ground squirrels.
- **10.2** Establish reporting and monitoring requirements for all study proposals. All study proposals should include an annual reporting and, if applicable, monitoring requirement. Information gathered during research activities should be included in a central database (see Task 2.0).
- **11.0 Assess implementation of the recovery plan and revise as necessary every 5 years.** This recovery plan should be reviewed every 2 years and, if necessary, revised every 5 years. Establishment of a recovery implementation team may be necessary to coordinate recovery actions.
 - 11.1 Establish an implementation team to coordinate recovery activities.

 We, in cooperation with other involved parties, will establish an implementation team to coordinate all recovery activities. This team will hold annual recovery implementation team meetings in late fall or early spring, and periodic meetings to coordinate management activities

on other public lands. Key to this effort will be coordination of habitat protection strategies, monitoring of recovery accomplishments and needs, compilation and dissemination of data through the establishment of a comprehensive database, and updating the recovery program based on new information and identified needs.

Table 3. Cross-reference of recovery tasks and listing factors.

SPECIES	LISTING FACTOR	THREAT	STILL A THREAT?	TASK NUMBERS	RECOVERY CRITERIA
Spermophilus brunneus	A	Forest encroachment into grassland meadows/fire suppression	yes	1.1.1, 1.1.4, 2.0, 3.2, 6.1, 7.1	1, 2, 3, 4, 5
brunneus	A	Conversion of meadows to agriculture	yes	1.3, 1.3.1, 2.0, 3.2, 4.2, 6.1	1, 3, 4
	A	Grazing practices		1.1.1, 1.1.3, 1.1.4, 1.3.2, 2.0, 4.2, 6.1, 7.1	1, 3, 4, 5
	A	Residential construction	yes	1.3.1, 2.0, 3.1, 3.2, 4.2, 5.0	3
	A	Development of recreational facilities, e.g. golf courses	yes	1.3.1, 2.0, 3.1, 3.2, 5.0	3
	A	Dam expansion for irrigation	yes	1.3.1, 2.0, 3.1, 3.2, 5.0	3
	A	Road construction and maintenance	yes	1.1.2, 1.2, 2.0, 3.1, 3.2, 4.0, 5.0	3
	В	Recreational shooting	yes	2.0, 4.1, 4.2, 5.0	4, 5
	С	Predation, primarily by badgers	yes	1.1.1, 2.0, 6.1, 6.4.1, 6.4.2	4, 5
	D	Inadequate local land use ordinances relating to housing developments	yes	1.1.3, 2.0, 3.1, 3.2, 5.0	2, 3
	Е	Land ownership patterns	yes	1.3.1, 2.0, 3.1, 3.2, 5.0	2, 3
	Е	Competition from the Columbian ground squirrel	yes	1.1.1, 2.0, 6.1, 6.3, 6.3.1	4, 5
	Е	Winter mortality	yes	1.1.1, 2.0, 6.1	4, 5

IV. IMPLEMENTATION SCHEDULE

The Implementation Schedule that follows outlines actions and costs for the recovery program. Its is a guide for meeting the objectives elaborated in Part II of this plan. This schedule indicates the general category for implementation, recovery plan tasks, corresponding outline numbers, task priorities, duration of tasks, responsible agencies, and estimated costs for tasks. These actions, when accomplished, should bring about the recovery of the northern Idaho ground squirrel and protect its habitat.

A. Recovery Action Priorities

Priority 1: Actions necessary to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.

Priority 2: Actions necessary to prevent a significant decline in species population or habitat quality, or other significant negative impact short of extinction.

Priority 3: All other actions necessary to provide full recovery of the species.

B. Acronym Definitions

IDFG - Idaho Department of Fish and Game

PNF- Payette National Forest

USFWS - U.S. Fish and Wildlife Service

FHA - Federal Highways Administration

BLM - Bureau of Land Management

NIDGS - northern Idaho ground squirrel

PWRC - U.S. Geological Survey, Patuxent Wildlife Research Center

WS - Wildlife Services

C. Definition of Task Durations

Continual - A task that will be implemented on a routine basis, once begun, until recovery.

Ongoing - A task that is currently being implemented and will continue until action is accomplished..

Asterisk - (*) Indicates lead agency(s).

		Implementation S	chedule for th	ne Northern Idaho	Ground So	quirrel R	ecovery	Plan			
Priority	Task	Task description	Task	Responsible		Cos	t estimat	Comments			
number	number		duration (years)	parties (Alphabetical)	Total cost	FY 200 2	FY 200 3	FY 200 4	FY 200 5	FY 200 6	
1	1.1.1	Amend the Payette National Forest Land and Resources Management Plan	2	PNF*	20	10	10				Dependent on availability of funds.
1	1.1.2	Implement road closures and other restrictions to protect known NIDGS population sites	Continual (14)	PNF*	60	10	10	10	10	10	
1	1.1.3	Develop site specific management plans for known population sites	3	PNF*	45	15	15	15			
1	1.1.4	Review and renew the conservation agreement between the Payette National Forest and the USFWS	1	PNF*, USFWS	0						Completed.
1	1.2	Monitor results of the Federal Highway Administration mitigation plan	On-going (4)	FHA*, UWFWS	40	10	10	10	10		
1	1.3.1	Seek the cooperation of State of Idaho, private and municipal landowners to protect known NIDGS population sites	Continual (14)	USFWS*, IDFG	50	10	10	10	10	10	
1	4.2	Inform adjacent landowners of NIDGS population sites nearby	Continual (14)	USFWS*, private	5	1	1	1	1	1	
1	5.0	Enforce existing State of Idaho and Federal protections for NIDGS	Continual (14)	IDFG*, USFWS, PNF	30	2.5	2.5	2.5	2.5	2.5	

		Implementation S	chedule for th	ne Northern Idaho	Ground So	quirrel F	Recovery	Plan			
Priority	Task	Task description	Task	Responsible		Cos	t estima	Comments			
number	number		duration (years)	parties (Alphabetical)	Total cost	FY 200 2	FY 200 3	FY 200 4	FY 200 5	FY 200 6	
1	9.1	Develop and implement a program to monitor NIDGS population sites	On-going (14)	USFWS*, IDFG	60	10	10	10	10	10	
1	9.2	Assure the adequacy of training of individuals conducting monitoring	On-going (5)	USFWS*, IDFG	10	2	2	2	2	2	
2	1.3.2	Monitor the success of the Safe Harbor Agreement on private lands	On-going (5)	USFWS*	5	1	1	1	1	1	
2	2.0	Establish a central database for information regarding NIDGS	Continual (14)	USFWS*, IDFG	20	2	15	1	1	1	
2	3.1	Develop and implement a program to systematically search for additional population sites	15	USFWS*, IDFG							Combined with task 9.1
2	3.2	Develop a reporting system for additional NIDGS population sites found	1	USFWS*, IDFG							Combined with task 2.0
2	6.1	Determine and gather information necessary to complete a PVA for NIDGS	2	USFWS*, IDFG	30		15	15			Graduate research study
2	6.2	Use information gathered through Task 6.1 to determine the status of the NIDGS and refine recovery goals	2	USFWS	15				7.5	7.5	
2	6.4.1	Establish a predator control program	On-going	USFWS*, WS	10	2	2	2	2	2	
2	6.4.2	Renew agreement to implement a predator control program	1	USFWS*, WS	2		2				

		Implementation S	chedule for th	ne Northern Idaho (Ground So	quirrel R	ecovery	Plan			
,	Task number	Task description	Task	Responsible	Cost estimates (\$1,000)						Comments
	number		duration (years)	parties (Alphabetical)	Total cost	FY 200 2	FY 200 3	FY 200 4	FY 200 5	FY 200 6	
3	4.1	Implement a program to provide education and public outreach for NIDGS recovery	Continual (14)	USFWS*, IDFG, PNF	25	5	5	5	5	5	
3	6.3	Conduct research regarding the interspecific interactions between the Columbia ground squirrel and NIDGS	4	USFWS*, IDFG	90	30	30	30			Graduate research study
3	6.3.1	Establish and implement a program to control Columbia ground squirrels	On-going (5)	USFWS*, WS, IDFG							Combined with task 6.4.1
3	6.4	Identify NIDGS predation rates and if significant, implement a control program to promote recovery	2	USFWS*, WS, IDFG	30		15	15			Graduate research study
3	6.5	Perform contaminants analysis on northern Idaho ground squirrel carcasses	3	USFWS	30		10	10	10		
3	7.1	Identify and enhance habitat for additional population sites	15	PNF*, USFWS	100	20	20	20	20	20	This task duration may be shorter depending on success of reintroductions
3	7.2	Develop management plans for each potential reintroduction site (includes geographic info. system mapping)	On-going (3)	PNF*, USFWS, IDFG	9		3	3	3		This task duration may be shorter depending on success of reintroductions

		Implementation S	chedule for th	ne Northern Idaho	Ground So	quirrel R	Lecovery	Plan			
Priority	Task number	Task description	Task	Responsible		Cos	Comments				
number	number		duration (years)	parties (Alphabetical)	Total cost	FY 200 2	FY 200 3	FY 200 4	FY 200 5	FY 200 6	
3	7.2.1	Manage restored habitat for reintroduction sites	15	PNF*, USFWS	150		10	10	10	10	This task duration may be shorter depending on success of reintroductions
3	7.3	Establish release protocol for reintroducing NIDGS into appropriate sites	1	PNF*, USFWS	10		10				This task duration may be shorter depending on success of reintroductions
3	7.3.1	Introduce NIDGS into managed sites	On-going Not every yr; (3)	PNF*, USFWS, IDFG	60		20	20	20		Graduate research study
3	7.3.2	Monitor introduced NIDGS and habitat	Continual (14)	PNF*, USFWS, IDFG	20		5	5	5	5	
3	7.3.3	Continue reintroductions at each population site for up to 3 years	On-going (3)	PNF*, USFWS, IDFG	8		2	2	2	2	This task duration may be shorter depending on success of reintroductions
3	8.0	Develop a captive breeding program	10	USFWS*, IDFG, Zoo- Boise	25		10	5	5	5	Pending agreement with Zoo-Boise
3	9.3	Implement a procedure for handling and disposition of road-killed or other dead specimens of NIDGS	Continual (14)	USFWS*, IDFG	0						
3	10.1	Develop and implement a program to address additional research needs	On-going (14)	USFWS*, IDFG, PNF	0						In conjunction with other research projects

	Implementation Schedule for the Northern Idaho Ground Squirrel Recovery Plan											
Priority	Task	Task description	Task duration (years)	Responsible parties (Alphabetical)	Cost estimates (\$1,000)						Comments	
number	number				Total cost	FY 200 2	FY 200 3	FY 200 4	FY 200 5	FY 200 6		
3	10.2	Establish reporting and monitoring requirements for all study proposals	On-going	USFWS*, IDFG, PNF	0						In conjunction with other research projects	
3	11.1	Establish an implementation team to coordinate recovery activities	Continual (14)	USFWS*, PNF, IDFG	40		10	10	10	10		

V. STAKEHOLDER INVOLVEMENT

Development of the Draft Northern Idaho Ground Squirrel Recovery Plan was initiated on November 13, 2000, when a recovery strategy meeting was convened. As a result of this meeting, a document titled the Northern Idaho Ground Squirrel Recovery Strategy Framework (U.S. Fish and Wildlife Service 2000) was sent out on January 26, 2001, to nine biologists who were involved with pre-listing recovery implementation, a U.S. Forest Service administrator, a rancher who owns private land containing key habitat - a stronghold for northern Idaho ground squirrels, and an environmental coordinator for the Boise Cascade Corporation. Comments from seven of the nine biologists were received, and oral comments were received from the rancher. The Forest Service administrator and the representative from Boise Cascade Corporation did not respond to our invitation. We incorporated the Framework responses into the draft Recovery Plan; a Regional Office review began November 30, 2001. On February 21, 2002, the Service received a letter from the rancher inviting the Idaho Department of Fish and Game to survey and monitor for northern Idaho ground squirrels on the ranch. We provide section 6 funds to the Idaho Department of Fish and Game to implement recovery strategies for the northern Idaho ground squirrel. We and the intend to coordinate survey and monitoring on the ranch for 2002 with the rancher and the Idaho Department of Fish and Game. This will allow population monitoring of northern Idaho ground squirrels by a State agency as a continuation of 12 years of monitoring conducted by scientists from Cornell University.

While we have elected not to formalize a recovery team since the listing of the northern Idaho ground squirrel (*Spermophilus brunneus*), a Northern Idaho Ground Squirrel Conservation Committee has been in place since 1996, when a Conservation Agreement was jointly signed by us and the Payette National Forest.

The Committee consists of agency biologists from the U. S. Fish and Wildlife Service, Forest Service, and Idaho Department of Fish and Game, and is open to participating stakeholders from the environmental, ranching, and forest products organizations. Two coordination meetings are held each year, one in the spring to decide the specifics of field work both in areas of population monitoring and habitat modifications, the other in the late summer to review annual accomplishments, address issues, and to set the direction for the next field season.

Two annual reports are submitted to us in November of each year. One is from Idaho Department of Fish and Game and documents population monitoring and survey work that was done during the field season. The other report is from the Payette National Forest and documents habitat modifications, enforcement actions, and other recovery activities as they relate to Federal lands where northern Idaho ground squirrels are found. These and technical studies, for example a nutrient analysis study on plant species initiated in 2001, a plant species and composition study initiated in 2000, a supplemental feeding feasibility project initiated in 2001, and a genetics study initiated in 2002 have been shared with all stakeholders.

Stakeholders who have consistently participated in meetings and who have received reports and studies include:

John Dyer and Frank Anderson, OX Ranch

Bob and Peggy Mack (Safe Harbor Agreement)

Brian Kernohan, Boise Cascade Corporation

Joe Hinson, Northwest Natural Resources Group

Jim Caswell, Office of Species Conservation (Governor's Office liaison)

Bruce Haak, Idaho Department of Fish and Game

Sheldon Keifer, Idaho Department of Lands

Bob Giles, Floyd Gordon, Lon Schultz, Payette National Forest

Lang Bangerter, Wildlife Services

Dr. Eric Yensen, Albertson College of Idaho

Dr. Paul Sherman, Cornell University

Dr. Michael Runge, USGS-BRD, Laurel, Maryland

Dr. Janet Rachlow, University of Idaho

Steve Duke, U.S. Fish and Wildlife Service Dennis Mackey, U.S. Fish and Wildlife Service Ben Matibag, U.S. Fish and Wildlife Service Rich Howard, U.S. Fish and Wildlife Service

VI. REFERENCES

A. Literature Cited

- Belovsky, G.E. and O.J. Schmitz. 1994. Plant defenses and optimal foraging by mammalian herbivores. Journal of Mammalogy 75:816-832.
- Burns, J. and J. Zborowski. 1996. Fire suppression and forest succession in Lick Creek Canyon and central Idaho. Albertson College of Idaho. Caldwell, Idaho. 19pp.
- Dyni, E. and E. Yensen. 1996. Dietary similarity in sympatric Idaho and Columbian ground squirrels (*Spermophilus brunneus* and *Spermophilus columbianus*). Northwest Science 70(2):99-108.
- Gavin, T.A., P.W. Sherman, and E. Yensen. 1998. Translocation and inventory of northern Idaho ground squirrels (*Spermophilus brunneus brunneus*) in 1998. Cornell University, Ithaca, New York, and Albertson College, Caldwell, Idaho. 11pp.
- Gavin, T.A., P.W. Sherman, E. Yensen, and B. May. 1999. Population genetic structure of the northern Idaho ground squirrel (*Spermophilus brunneus brunneus*). Journal of Mammalogy 80:156-168.
- Gill, A.E. and E.Yensen. 1992. Biochemical differentiation in the Idaho ground squirrel, *Spermophilus brunneus* (Rodentia: Sciuridae). Great Basin Naturalist 52(2):155-159.
- Haak, B. 2000. Northern Idaho ground squirrel population monitoring and habitat mitigation, 2000 annual report. Idaho Department of Fish and Game, Boise, Idaho. 12 pp.
- Haak, B. 2001. Northern Idaho ground squirrel population monitoring and habitat mitigation, 2001 annual report. Idaho Department of Fish and Game, Boise, Idaho. 11 pp.

- Hershkovitz, P. 1949. The status of names credited to Oken, 1816. Journal of Mammalogy 30:289-301.
- Howell, A. 1938. Revision of the North American ground squirrels, with a classification of the North American Sciuridae. North American Fauna 56:1-256.
- Idaho Department of Fish and Game. 1992. Rare, threatened and endangered plants and animals of Idaho. Conservation Data Center, Idaho Department of Fish and Game, Boise, Idaho. 38pp.
- Idaho Department of Fish and Game. 1997. Atlas of Idaho's Wildlife. Idaho Department of Fish and Game, Nongame and Endangered Wildlife Program, Boise, Idaho. 81pp.
- Mangel, T. and C. Tier. 1994. Four facts every conservation biologist should know about persistence. Ecology 75(3):607-6 14.
- Nadler, C.F., L.W. Turner, R.S. Hoffmann, and L. Deutsch. 1973. Chromosomes and giemsabands of the Idaho spotted ground squirrel, *Spermophilus brunneus* (Howell). Experentia 29:893-894.
- Runge, M. 1999. Northern Idaho ground squirrel population model and users manual. U.S. Geological Survey- Patuxent Wildlife Research Center. Laurel, Maryland. 15pp.
- Sherman, P.W. and T.A. Gavin. 1997. Transplanting northern Idaho ground squirrels (*Spermophilus brunneus brunneus*). Cornell University, Ithaca, New York. 8pp.
- Sherman, P.W. and T.A. Gavin. 1999. Population status of northern Idaho ground squirrels (*Spermophilus brunneus brunneus*) in early May 1999. Cornell University, Ithaca, New York. 11pp.

- Sherman, P. and E. Yensen. 1994. Behavior and ecology of Idaho ground squirrel. Annual report detailing results of the 1993 field season. Cornell University, Ithaca, New York. 12pp.
- Stoddard, S.E. 2001. A historical perspective on the population reduction of northern Idaho ground squirrels in west-central Idaho, 1930-1982. Payette National Forest. McCall, Idaho. 12 pp.
- Truksa, A. and E. Yensen. 1990. Photographic evidence of vegetation changes in Adams County, Idaho. Journal of the Idaho Academy of Science 26:18-40.
- U.S. Department of Transportation, Federal Highway Administration, Western Federal Lands Highway Division. 1998. Council-Cuprum Road, Idaho Forest Highway 63-1(2), Payette National Forest, Adams County, Idaho. Environmental Assessment. Western Federal Lands Highway Division, Federal Highway Administration, Vancouver, WA. 36pp.
- U.S. Fish and Wildlife Service. 1985. Final report for the Idaho ground squirrel. Memorandum from Field Supervisor, Idaho State Office, to Chief, Endangered Species Program, Portland, Oregon. 2pp.
- U.S. Fish and Wildlife Service. 1996. Conservation agreement *Spermophilus* brunneus brunneus northern Idaho ground squirrel. Prepared jointly by U.S. Fish and Wildlife Service and U. S. Forest Service. 14pp.
- U.S. Fish and Wildlife Service. 2000. Northern Idaho Ground Squirrel Recovery Strategy Framework. Snake River Basin Office, Boise, Idaho. 22pp.
- U.S. Fish and Wildlife Service. 2000b. Safe harbor agreement with Bob and Peggy Mack for the northern Idaho ground squirrel. Snake River Basin Office, Boise, Idaho. 19pp.
- U.S. Forest Service. 1997. Biological assessment, evaluation and mitigation for the Council to Cuprum Road project PFH-63-1(2). Council Ranger District, Payette National Forest, Council, Idaho. 35pp.

- U.S. Forest Service. 2000. Habitat restoration plan (2001-2006) for the northern Idaho ground squirrel (*Spermophilus brunneus brunneus*). U.S.D.A., Payette National Forest, McCall, Idaho. 25pp.
- Yensen, E. 1985. Taxonomy, distribution, and population status of the Idaho ground squirrel, *Spermophilus brunneus*. Department of Biology, Albertson College of Idaho, Caldwell, Idaho. 41pp.
- Yensen, E. 1991. Taxonomy and distribution of the Idaho ground squirrel *Spermophilus brunneus*. Journal of Mammalogy 72(3):583-600.
- Yensen, E., C.R. Baird, and P.W. Sherman. 1996. Larger ectoparasites of the Idaho Ground Squirrel (*Spermophilus brunneus*). Great Basin Naturalist 56(3):237-246.
- Yensen, E., D.L. Quinney, K. Johnson, K. Timmerman, and K. Steenhof. 1992. Fire, vegetation changes, and population fluctuations of Townsend's ground squirrels. American Midland Naturalist 128:299-312.
- Yensen, E., M.P. Luscher, and S. Boyden. 1991. Structure of burrows used by the Idaho ground squirrel, *Spermophilus brunneus*. Northwest Science 65(3):93-100.
- Yensen, E. and P. Sherman. 1997. Spermophilus brunneus. Mammalian Species. No. 560, pp. 1-5. Published by American Society of Mammalogists.

B. Personal Communication

Bangerter, Layne, 2001. Personal communication and accomplishment report summary presented to Rich Howard, USFWS at the northern Idaho ground squirrel recovery meeting on October 25, 2001, from Layne Bangerter, Wildlife Services. Subject: Predator control during 2001 at northern Idaho ground squirrel sites.

- Sherman, Paul. 1999. Personal communication dated June 2000 between Rich Howard, USFWS and Paul Sherman, Cornell University. Subject: Status of former northern Idaho ground squirrel sites on OX Ranch, Bear, Idaho.
- Yensen, Eric. 1999. Personal communication between Eric Yensen, Albertson College of Idaho, and Rich Howard, USFWS. Subject: Shooting ground squirrels for sport as a source of mortality in Adams and Valley Counties.

VII. GLOSSARY

The consistent use of terminology is important to eliminate confusion when addressing the site characteristics and population dynamics of the northern Idaho ground squirrel. Terms such as "colonies" and "populations" have been applied to prairie dogs and ground squirrels to characterize their social behavior and genetic linkage. However, more specific and distinct definitions were developed for the listing document and this recovery plan. These definitions are based on the behavior of this species, which is less than colonial but not as singular and isolated as the rock squirrel (*Spermophilus variegatus*). They also are based on topography and ultimately genetics. References for this terminology include Gavin *et al.* (1999) and Runge (2001). The following definitions are used throughout this recovery plan:

<u>Sub-site</u>. A sub-site is composed of squirrels that maintain burrow systems within calling distance of each other, utilize common food resources, and routinely travel over the extent of the sub-site during the course of the active season (March-July).

<u>Population site</u>. A population site is composed of sub-sites that are within several hundred meters of each other and are not separated by geographic barriers. Movement back and forth among sub-sites within a population site is not routine, but natal and adult dispersal among sub-sites occurs on a regular basis (yearly, or at least as often as once every several years).

<u>Population complex</u>. A population complex is composed of several population sites that are not separated by geographic barriers to dispersal, but that are far enough apart to make exchange of migrants very rare.

Extensive monitoring. Annually during the spring or summer, one or more visits are made to a population site to conduct a visual estimate of the number of squirrels at the site. No attempt is made to trap or mark squirrels. Standardized and time-efficient monitoring protocols are used to conduct this type of population assessment.

<u>Intensive monitoring</u>. Annually during the spring and summer, numerous visits

are made to a population site to conduct a population assessment. This process includes trapping, weighing, sexing, and marking of adults and yearlings. An attempt is made to capture all the squirrels at a population site during these visits. However, its unusual that juvenile squirrels are trapped during intensive monitoring because of the amount of time and staff required, stage of vegetation, and overall difficulty.